

# Next Generation Real Time Solar Wind (RTSW) Energetic Particle Detector



## **Fundamental Question:**

What energetic particle observation is required for the next generation RTSW system?

## **Why is the question important:**

Space weather forecasting requires specific observations for model inputs.

## **Science Objectives:**

- Energetic ion and electron observations are used in modeling efforts to predict the arrival of Energetic Storm Particle (ESP) events.
- Advanced space weather forecasting requires detailed angular, spectral, and compositional observations.
- The next generation RTSW Energetic particle detector must make these key observations

## **Mission Description:**

- Observations from a spinning spacecraft that stations well upstream of the Earth, as well as additional inner-heliospheric missions
- Continuous telemetry coverage
- Entire payload consists of magnetic field, plasma, and energetic particle instruments

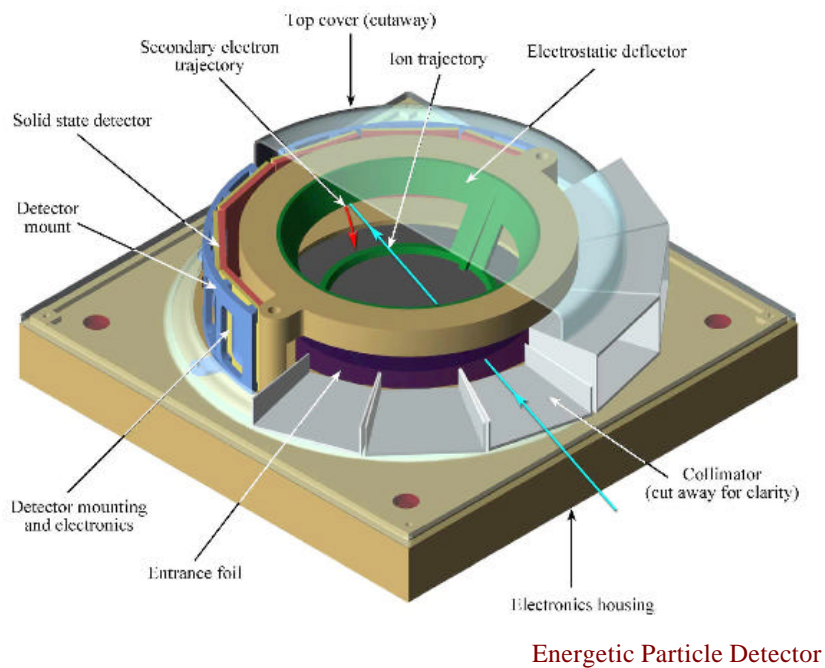
## **Measurement Strategy:**

- Total ion measurements with good angular and energy resolution
- Elemental composition measurements
- Electron measurements with good angular and temporal resolution
- One minute temporal resolution
- 12 seconds spin rate
- One high energy telescope that measures  $E > 10$  MeV and  $E > 30$  MeV ion

## **Technology Requirement:**

- Low power, low mass time-of-flight circuitry
- Low power, low mass integrated energy circuitry
- Good angular and temporal coverage compact energetic electron detector
- Onboard automatic spacecraft processing to reduce Earth-based data handling and analysis requirements

# Technical description of the Next Generation RTSW energetic particle detector



## Ion and Composition detection

- One 6 sectors time-of-flight ion detector covering  $4\pi$  sr when the spacecraft spin is included
- Total ion detector system uses  $<1$  Watt of power and  $<1$  kg
- Energy range is  $(0.02 < E < 5)$  MeV

## Electron detection

- One 12 sectors magnetically deflected electron detector mounted similar to the ion detector
- Total electron system uses  $\sim 1/2$  Watt of power
- Magnetically deflected electron system measures electrons from  $(30 < E < 350)$  keV

## High Energy telescope

- Simple SSD stack with appropriate absorbers, adjusted to return the required energy coverage
- Energy coverage from  $(5 < E < 30)$  MeV

## Telemetry requirements for the EPD

Species	# detectors	# channels	# sectors	# words
Electrons	12	4	12	576
Protons	6	5	12	360
He	6	5	1	30
CNO	6	5	1	30
Fe	6	5	1	30
High E ions	2	2	1	4

This robust system requires only  $\sim 50$  bytes/sec (16 bit words), similar to the current RTSW downlink. This would need to be expanded to include the plasma and magnetic field observations